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Nutritional and health benefits of walnuts

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Abstract

Walnuts are commonly found in our diet and have been recognized for their nutritious properties over a long period of time. Traditionally, walnuts have been known for their lipid profile which has been linked to a wide array of biological properties and health-promoting effects. In addition to essential fatty acids, walnuts contain a variety of other bioactive compounds such as, vitamin E and polyphenols. Among common foods and beverages, walnuts represent one of the most important sources of polyphenols, hence, their effect over human health grabs attention. Walnuts possess well known antioxidant and anti-inflammatory bioactivity and several studies have assessed the potential role of walnuts against disease initiation and progression, including cancer, cardiovascular and neurodegenerative diseases.

Keywords: Walnuts, ellagitannin, neurodegenerative and polyphenols

Introduction

Persian walnuts, (*Juglans regia* L), is one of the most important nutritive nut crop which belongs to the angiospermic family, *Juglandaceae*. The origin of walnuts is reported to arise from a vast area in Central Asia throughout Eastern Europe including Iran, Turkey, Iraq, Afghanistan, Southern Russia and Northern India. Technically, walnut is the seed of a drupe or drupaceous nut, and thus not a true botanical nut.

Walnut is one of the most important temperate nut grown all over the world over an area of 607.81 thousand hectares with an annual production of 892.760 MT (International Nut and Dried Fruit Council INC, 2016-2017) [5]. China is the world's largest producer of walnuts and India ranks seventh in world walnut production. The major walnut growing states of India are Jammu and Kashmir, Uttarakhand, Himachal Pradesh and Arunachal Pradesh.

Walnut kernel is a rich source of proteins, fats, vitamins, minerals and polyphenols which makes the fruit indispensable for human nutrition. They are also a good source of flavonoids, sterols, pectic substances, phenolic acids and related polyphenols. Walnuts have high amount of omega-6 and omega-3 polyunsaturated fatty acids which are essential dietary fatty acids. The main benefits of walnut kernels include lowering of cholesterol, increasing the ratio of high-density lipoprotein cholesterol to total cholesterol, reducing inflammation and improving arterial function. Walnuts contribute nutrients that are essential to a healthy lifestyle. The nutritional contents differs from cultivar to cultivar which can be influenced by geno-types, different ecologies and soil types (Caglarirmak, 2003; Crews *et al.*, 2005; Martinez *et al.*, 2010; Muradoglu *et al.*, 2010) [1, 2, 10, 11].

Overview of major nutritional composition and associated health benefits**Fats**

Walnuts contain about 65% fat by weight. Like other nuts, most of the energy in walnuts comes from fat. This makes them an energy-dense, high-calorie food. However, even though walnuts are rich in fat and calories, studies indicate that they do not increase the risk of obesity when replacing other foods in the diet. The major constituents of the oil are triacylglycerols; free fatty acids, diacylglycerols, monoacylglycerols, sterols, sterol esters and phosphatides are all only present in minor quantities (Prasad, 1994) [12]. The major fatty acids found in walnut oil are oleic (18:1), linoleic (18:2) and linolenic (18:3) acids. The most abundant one is an omega-6 fatty acid called linoleic acid. They also contain a relatively high percentage of a healthy omega-3 fat called alpha-linolenic acid (ALA). This makes up around 8–14% of the total fat content. In fact, walnuts are the only nuts that contain significant amounts of ALA. ALA is considered to be especially beneficial for heart health. It also helps reduce inflammation and improve the composition of blood fats. ALA is also a precursor for the long-chain omega-3 fatty acids EPA and DHA, which have been linked with numerous health benefits

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Amino acids

Proteins are present in abundant quantity in walnuts (protein is made up of individual amino acids some of which are essential in the diet). The value of protein content of walnuts is reported to range from 13.6 to 18.1g crude protein/100 g DM (Savage, 2000) ^[17]. Walnuts contain a relatively low content of lysine and high levels of arginine (Ruggeri *et al.*, 1996) ^[14]. The high levels of arginine in walnuts has already been identified as a positive feature as arginine can be converted into nitric oxide, a potent vasodilator, which can inhibit platelet adhesion and aggregation (Sabaté and Fraser, 1993) ^[15, 16]. Savage (2001) ^[18] showed that the ratio of lysine/arginine for 12 different cultivars grown in New Zealand to be 0.24 which is much lower than other common proteins (Lavedrine *et al.*, 1999) ^[7]. A low ratio of lysine/arginine in a protein has been identified as a positive feature for reduction of the development of atherosclerosis in laboratory animals (Kritchevsky *et al.*, 1988) ^[6].

Dietary fibre

Walnuts may protect against coronary heart disease through a number of mechanisms (Sabate *et al.*, 1993; Fraser, 1994) ^[15, 16, 3]. Fibre is mentioned as one of the eight possible positive constituents of nuts (Hu *et al.*, 1998) ^[4]. The total dietary fibre content of 12 different cultivars of walnuts from New Zealand ranged from 3.1 to 5.2 g/100g dry matter (Savage, 2000) ^[17].

Sterols

Phytosterols have been recognised as cholesterol-lowering agents since the early 1950's (Ling and Jones, 1995) ^[8]. Plant sterols appear to pass through the intestinal tract almost unabsorbed

(Raicht *et al.*, 1980) ^[13] but plant sterols also appear to interfere with the absorption of cholesterol, thus lowering the blood cholesterol levels. Moderate intakes of dietary plant sterols decrease serum total cholesterol and LDL-cholesterol levels as reported in human and animal model studies (Mattson *et al.*, 1977) ^[9]. The ranges of sterols found in walnuts are enough to exert a positive effect on human metabolism but this in turn depends on the amount of walnuts eaten on a regular basis.

Vitamins and Minerals

Walnuts are an excellent source of several vitamins and minerals, including:

Vitamin E: As compared to other nuts, walnuts contain high levels of a special form of vitamin E called gamma-tocopherol. Vitamin E has high antioxidant activity and plays an important role against oxidation of fats in lipid membranes. Lavedrine *et al.*, (1999) ^[7] has presented some data on the vitamin E content of walnuts grown in France and the USA. They identified gamma-tocopherol as the main tocopherol in walnut oil. The tocopherol content of New Zealand walnuts ranges from 290-435 mg/g oil. In fact, walnuts ranked second in a study investigating the antioxidant content of 1113 foods commonly eaten in the US.

Vitamin B6: This vitamin may strengthen the immune system and support nerve health. A vitamin B6 deficiency may cause anemia

Folic acid: Also known as folate or vitamin B9, folic acid has many important biological functions. A folic acid deficiency during pregnancy may cause birth defects.

Copper: This mineral promotes heart health. It also helps maintain bone, nerve and immune system function.

Phosphorus: About 1% of our body is made up of phosphorus, a mineral that is mainly present in bones. It has numerous functions in the body.

Manganese: This trace mineral is found in the highest amounts in nuts, whole grains, fruits and vegetables

Other Plant Compounds

Walnuts contain a complex mixture of bioactive plant compounds. They are exceptionally rich in antioxidants, which are concentrated in the thin, brown skin. Some notable plant compounds found in walnuts include:

Ellagic acid: This antioxidant is found in high amounts in walnuts, along with other related compounds like ellagitannins. Ellagic acid may reduce the risk of heart disease and help suppress cancer formation.

Catechin: Catechin is a flavonoid antioxidant that may have various health benefits. It may also promote heart health.

Melatonin: This neurohormone helps regulate the body clock. It is also a powerful antioxidant that may reduce the risk of heart disease.

Health benefits

The health benefits of walnuts are attributed to the nutritional components it contains.

Reduce Risk of developing cancer

The predimed human study, which assessed the Mediterranean diet, found that eating walnuts reduced cancer mortality. Animal studies have shown consuming walnuts significantly reduced the number and size of breast cancer tumors. Researchers suggested that omega-3 fatty acids, antioxidants, and phytosterols in walnuts are responsible for the benefits.

One Ounce of Walnuts decreases cardiovascular risk

Various studies have shown that adding walnuts can significantly decrease total and LDL cholesterol. In an Iranian study, 52 volunteers were divided into 2 groups. One group ate 20 grams of walnuts per day and the other group ate none. After eight weeks, the walnut group lowered their triglyceride levels by 17.1% and increased their HDL (good) cholesterol by 9%.

Walnuts help to reduce body weight

In a Harvard Medical School study, 20 men and women with metabolic syndrome participated in a randomized, double-blind, crossover study of walnut consumption. Subjects consumed a shake containing either walnuts or a placebo in breakfast. After just three days, those drinking the walnut shake reported feeling more satisfied and less hungry.

Walnuts improve endocrine parameters in polycystic ovary syndrome (PCOS)

In another study from UC Davis, 31 patients with polycystic ovary syndrome (PCOS) randomly received either walnuts or almonds containing 31 grams of total fat per day for 6 weeks. PCOS is commonly associated with insulin resistance, dyslipidemia and increased inflammation. The walnuts

decreased LDL cholesterol by 6%. They also increased insulin response and sex hormone-binding globulin.

Walnuts help to control Diabetes

Australian researchers studied 50 overweight adult diabetics in a one year program where participants received low-fat dietary plan. But half the subjects also ate 30 grams of walnuts per day. In the first three months the walnut group significantly lowered their fasting insulin levels.

Walnuts Improve Thinking Ability

In a crossover study, researchers assigned 64 college students to eat walnuts or a placebo. After eight weeks they found that walnut eaters had increased their inferential verbal reasoning abilities by 11.2%. Other studies show that greater intake of high-antioxidant foods such as walnuts may increase "health span" and enhance cognitive and motor function in aging.

Conclusion

Walnuts are rich in heart-healthy fats and high in antioxidants. Additionally, regular consumption of walnuts may improve brain health and help prevent heart disease and cancer. These nuts are easily incorporated into the diet, since they can be eaten on their own or added to many different foods. Simply put, eating walnuts may be one of the easiest things you can do to improve your health.

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